Engineering Response to FCC's Dec 18th Request for AirCell Mobile Transmit Power Data

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1 Engineering Response to FCC Request for Data

1.1 Introduction & Summary

V-COMM has prepared this report in response to the FCC's request for additional data, which is representative of the normal day-to-day operations of the AirCell system, per the FCC Letter dated December 18, 2003 (FCC Letter) from Katherine M. Harris, Deputy Chief, Mobility Division, Wireless Telecommunications Division, to assist the FCC in the evaluation of AirCell system.[1]

Specifically, the FCC Letter requests the "actual day-to-day operating data showing the output power (preferably in dBm) that the airborne transmitters utilize", which represents "ordinary, everyday operating data" for the AirCell system, and specifically is "not looking for additional data recorded during special tests conducted by parties or their consultants under controlled conditions."

In this report, V-COMM provides the information the FCC has specifically requested, which is airborne mobile transmit data from *actual* AirCell customers, from a number of AirCell sites in the northeast. As previously indicated (per the letter filed by opposing parties on 1/16/04), such data is not routinely recorded by the cellular system, due to limitations in its data monitoring capabilities. For this reason, special test equipment must be utilized at the AirCell sites to record this data. With these recordings, the airborne mobile transmit power levels are captured from *actual* AirCell customer calls.

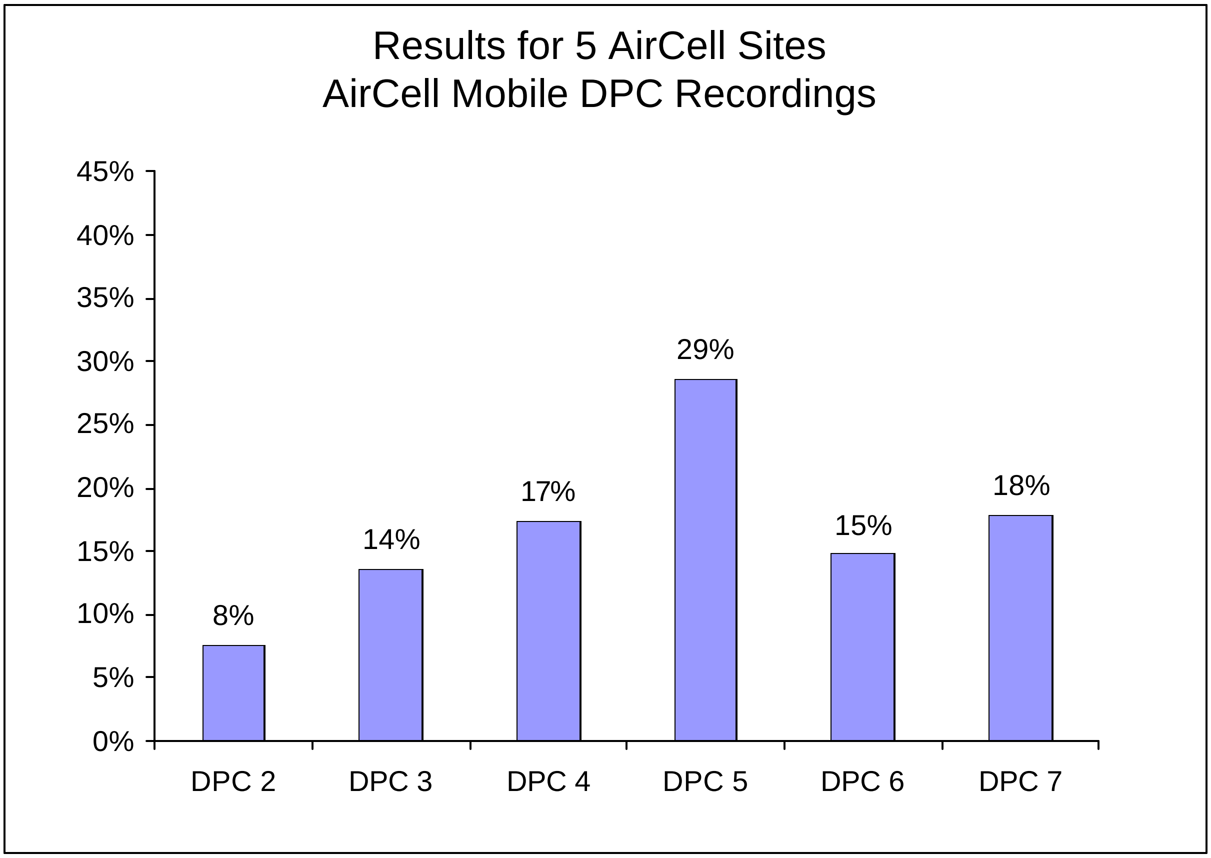
The results of the study show a distribution of airborne transmit power levels that utilize each Dynamic Power Control (DPC) level for a significant percent of time. The two highest power levels DPC 2 and DPC 3 (representing nominal transmit power levels of +19 and +15 dBm, respectively), were utilized 22% of the time. AirCell submitted power level data for a number of controlled flight tests on January 16, 2003, and its flight tests showed similar results. Both of these sets of data also serve to validate the previous test results of V-COMM's 2001 flight tests on the Marlboro AirCell site.

This study includes mobile DPC recordings for 33 days, with a total of 98 calls captured from actual AirCell customers having a total of 134 minutes of use, as served from 5 AirCell sites in the northeast. Of the 98 calls, only two calls were observed to handoff to other AirCell sites, or about 2% of the calls handing off.[2] The combined results of the study for the 5 AirCell sites are provided in Figure 1 (below).

[1] V-COMM has collected such data and is providing this report pursuant to a contract with AT&T Wireless, Cingular Wireless, and Verizon Wireless. For additional information pertaining to V-COMM's company background and profile, refer to Appendix Section 2.4.

[2] This is consistent with previous statements made by V-COMM in the record, concerning the likelihood of AirCell calls handing off, due to the economics of leasing voice trunk lines from non-adjacent cellular markets, or from adjacent A-Band to B-band AirCell sites.

Figure 1 AirCell Mobile DPC Results for 5 AirCell Sites



1.2 Description and Overview of Data Collection

This study includes 5 AirCell sites in the northeast, which are located in Marlboro, NJ; Ellendale, DE; Pecks, PA; Altoona, PA; and Owego, NY.[3] It is expected that these sites are representative of other AirCell sites across the country, and represent the normal day-to-day operation of the AirCell system. The sites are configured and optimized by AirCell.[4] A total of 33 days of recordings were made, with approximately 5 to 8 days of recordings for each of the AirCell sites.

[3] A map depicting these five AirCell sites is provided in Appendix Section 2.2.

[4] It was observed that the Altoona and Owego AirCell sites used a different voice channel assignment sequence ("round-robin" assignment) as compared to the other 3 sites studied (Marlboro, Ellendale & Pecks used "sequential hunt" assignment). To facilitate the gathering of data within the 30 day extension period and with limited test receiver ports, the selection sequence was adjusted for Altoona and Owego to be consistent with the other 3 AirCell sites, and to facilitate the capture of more airborne mobile calls than would have been possible under the "round robin" assignment.

The Marlboro and Ellendale sites were monitored with test equipment within the AirCell cell site buildings, and the three other AirCell sites were monitored from nearby locations. The cellular operator of the Pecks site is not an opposing carrier, and a nearby location was used to perform the recordings. The two AT&T Wireless (AWS) sites (Altoona and Owego) were recorded from nearby locations, as these sites were inaccessible due to snow covered road conditions. The nearby locations had good visibility of the AirCell site towers (within approx. 2 miles of the tower), and utilized test equipment receivers with cellular antennas directed at the towers, within windows of nearby hotel buildings. The receivers were able to measure the AirCell site's forward link signals at good signal levels, and capture over-the-air Dynamic Power Control (DPC) messages sent via the AirCell site's forward-link AMPS setup channels and voice channels.[5]

For the data collection, the forward-link power control messages were captured on the AMPS setup channels and voice channels utilized by the AirCell sites. The forward-link received signal strength data was also captured, as well as the SAT of the AirCell signal and the mobile numbers (MINs) of AirCell customers placing or receiving calls on the AirCell system. The airborne mobile phone transmit power levels were recorded as Dynamic Power Control (DPC) levels by the test equipment. For these recordings, V-COMM utilized test equipment from Allen Telecom, the Grayson GMR200 Receiver (Grayson), which is specifically designed to monitor AMPS setup channel and voice channel signal data from AMPS cellular base stations and mobile phones. The data recorded by the Grayson equipment includes the Dynamic Power Control (DPC) messages, which are sent over the AMPS setup channel, for the initial DPC level for the beginning of a call, and over the AMPS voice channels for subsequent DPC levels, as recorded for calls in progress.

The data was post-processed, and the results tabulated for the amount of time (# of seconds) each DPC level was utilized. The results of the study for all calls from actual AirCell customers served by the five AirCell sites are provided below.[6]

[5] AirCell's airborne transceivers are directed by the AirCell sites as to which DPC level to operate, per DPC commands sent on the forward-link setup and voice channels, which are dependent upon the site's received signal strength of the AirCell mobiles and their relationship to the DPC power window.

[6] As described in the next section, some calls were removed from the data, as they clearly appeared to be from AirCell's Call Boxes (CTSU) or AirCell Test Phones at the AirCell sites, and not from actual airborne customers.

1.3 AirCell Mobile DPC Results

The results of the AirCell mobile DPC recordings taken at 5 AirCell sites are provided in Table 1 & Figure 2 (below). These results represent a total of 33 days of data, and a total of 98 calls made by *actual* AirCell customers utilizing 134 minutes of use on the AirCell network.[7] The results show the occupancy percentages for each DPC Level utilized (DPC 2 through DPC 7), for all customer calls recorded at the 5 AirCell sites. Individual site results are provided in Appendix Section 2.1 of this report.

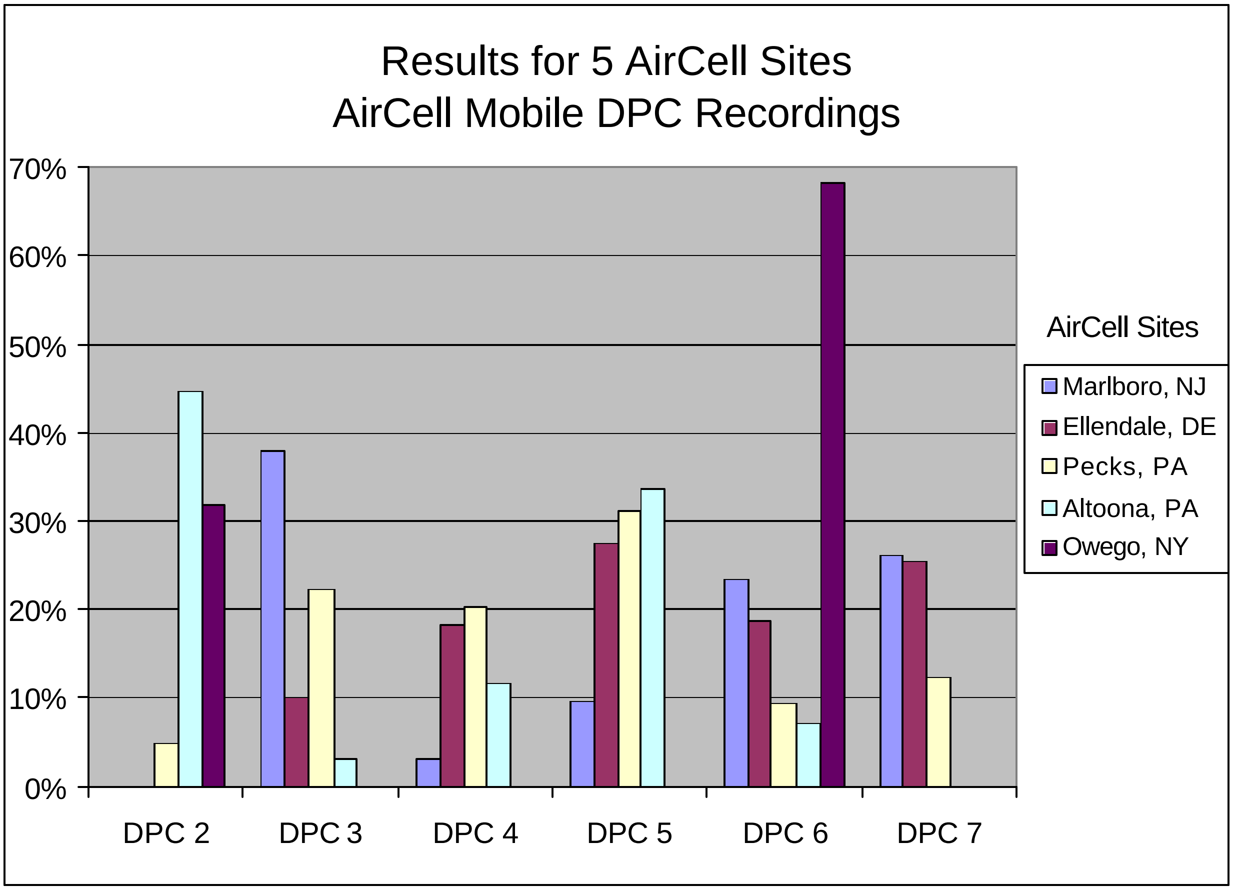
Table 1 AirCell Mobile DPC Results for 5 AirCell Sites

Results for 5 AirCell Sites
AirCell Mobile DPC Recordings

				Call Time	DPC Step Percentages					
	AirCell Site	**# Days**	**# Calls**	**(Minutes)**	**DPC 2**	**DPC 3**	**DPC 4**	**DPC 5**	**DPC 6**	**DPC 7**
1	Marlboro, NJ	4	14	4.4	0%	38%	3%	10%	23%	26%
2	Ellendale, DE	8	45	71.3	0%	10%	18%	28%	19%	25%
3	Pecks, PA	7	23	39.6	5%	22%	20%	31%	9%	12%
4	Altoona, PA	7	14	18.1	44%	3%	12%	34%	7%	0%
5	Owego, NY	7	2	0.7	32%	0%	0%	0%	68%	0%
	TOTALS:	33	98	134.1						
	Total Time, per DPC Step (Minutes):				10.2	18.2	23.4	38.4	19.9	24.0
	Total Percentages, per DPC Step :				8%	14%	17%	29%	15%	18%

[7] Additional calls were recorded during the measurement period, however these calls appear to be from AirCell's Call Boxes (CTSU) or AirCell Test Phones at the AirCell sites because they followed strict and consistent calling patterns. AirCell was asked to provide the MINs from their Test Phones at the sites included in the study, however AirCell did not provide this information. Consequentially, V-COMM made good-faith estimates to identify and remove the AirCell's "test calls". For example, at the Pecks PA site, calls from two mobile phone numbers (MINs) followed the exact same call pattern every night, seizing the voice channel at the exact same moment (i.e. at 10:18:50 pm ET), with precisely the same hold time between calls (i.e. 8 seconds), with consistent call durations, and at the same power level, as if dialed by a computer routine as part of a remote monitoring system. Accordingly, any calls from these two MINs were removed from all the data at the Pecks site.

Figure 2 AirCell Mobile DPC Results for 5 AirCell Sites



Individual Site Results

As observed from results for the Marlboro AirCell site, the DPC level 3 was the highest probability of occurrence at 38%, over the measurement period of 4 days, with no occurrences for DPC Level 2, and substantially lower occurrences for DPC Level 4 and 5. The results for the Marlboro site represent a small sample of data; however the utilization of the DPC Level 3 at 38% for actual customers compares closely with the results achieved for V-COMM's "straight-line" flight route utilized in 2001 flight tests (as filed at the FCC), which was 33%.

With the recordings at the Marlboro site capturing a total of 14 calls (having a total of 4.4 minutes of use)[8], V-COMM had planned to take additional measurements at the Marlboro site, to add to the data sample provided to the FCC. However, AirCell instructed Cingular to decommission the Marlboro and Ellendale sites during study period. For this reason, no further recordings were possible at the Marlboro site.

[8] Some customer calls on the Marlboro AirCell site were observed to be short in duration due to busy or non-answered phone calls.

As observed from results for the Ellendale AirCell site, the DPC level 5 was the highest probability of occurrence at 28%, over the measurement period of 8 days, capturing a total of 45 calls from actual AirCell customers representing 71.3 minutes of use.

As observed from results for the Pecks AirCell site, the DPC levels 5 and 3 were the highest probability of occurrences at 31% and 22%, respectively, over the measurement period of 7 days, capturing a total of 23 calls from actual AirCell customers representing 39.6 minutes of use. Over the duration of the recordings at this site, the DPC Level 2 was utilized approximately 5% of the time by AirCell customers.

Per AirCell's instructions, Cingular decommissioned the Marlboro and Ellendale AirCell sites at 3:34 pm on 1/30/04. These two sites were on-air throughout all the recordings for the Marlboro, Ellendale and Pecks AirCell sites, and they were shut-off afterwards. Therefore, the results for the Pecks site represents the AirCell system with nearby sites Marlboro and Ellendale on-air. Since Marlboro and Ellendale are decommissioned, the Pecks site now needs to serve a larger coverage radius (i.e. to the southeast) than previously, and can be expected to serve a higher percentage of calls at higher power levels than indicated by this study.

As observed from results for the Altoona AirCell site, the DPC level 2 was the highest probability of occurrence at 44%, over the measurement period of 7 days, capturing a total of 14 calls from actual AirCell customers representing 18.1 minutes of use. Based on the results of all 5 sites, the Altoona site results observed the highest percentage of customer calls at the DPC Level 2 operation.

As observed from results for the Owego AirCell site, the DPC Levels 6 and 2 were the only levels utilized at 68% and 32%, respectively, due to the low level of usage on this AirCell site. The recordings were performed over a period of 7 days at this site, and only captured a total of 2 calls from actual AirCell customers representing 0.7 minutes of use.

The data collection at the Altoona and Owego sites was performed after the Marlboro & Ellendale sites were decommissioned. This data was not affected by the decommissioning since they are not adjacent to either Marlboro or Ellendale.

<u>Results of All 5 Sites</u>

Based upon the collective results for all 5 sites, the mobile DPC Levels 2 through 7 were utilized by the AirCell system at 8%, 14%, 17%, 29%, 15%, and 18%, respectively. These were recorded for AirCell customer calls occurring during the study period of 33 days in total, and consisted of a total of 98 customer calls having 134 minutes of use on the AirCell network.

Based upon the collective results for all 5 sites, the DPC Level 5 was the highest utilized at 29%, however at some AirCell sites the DPC Levels 2 and 3 were the most utilized.

The Altoona site observed the highest percentage of customer calls at the DPC Level 2, and the Marlboro site observed the highest percentage of customer calls at the DPC Level 3.

Overall, it is observed that the AirCell system utilizes all of its mobile power levels (DPC Levels 2 through 7) to serve customer calls on its network, with individual AirCell sites achieving slightly different results. This can be attributed to a number of factors including the orientation and distance of the airplane's flight route to the serving AirCell site, the altitude of the flight, the type of aircraft antenna (VOR or belly mounted type) and the type of base station antenna utilized. Overall, the data indicates that the AirCell system uses all its power levels for a significant portion of time.

Overall, the results of this study are substantially similar to the results of the V-COMM straight-line flight tests utilized in 2001.[9] This was expected (that both sets of data are similar), as the straight-line flight routes utilized in the 2001 flight tests were selected to be typical roadways in the sky. In comparison to utilization of DPC Level 3 that occurred 33% of the time during V-COMM's flight tests in 2001,[10] the sites included in this study have similar results (except for Ellendale), when totaling the times for operation at DPC Level 2 and 3. For this study, the DPC Levels 2 and 3 were utilized a total of 38% for the Marlboro site, 10% for the Ellendale site, 27% for the Pecks site, 47% for the Altoona site, and 32% for the Owego site. In addition, for V-COMM's 2001 flight tests, the DPC Level 5 was the 2nd highest utilization at 23.4%, and for this study of 5 sites, the DPC Level 5 was utilized 29%. The results of this study, provides further evidence to the Commission that the previous 2001 flight tests are valid.

[9] For reference, the mobile DPC results of V-COMM's 2001 straight-line flight tests are provided in Appendix Section 2.3, Figure 10. These results were submitted to the Commission on April 10, 2003, within V-COMM's Engineering Report of the AirCell Compatibility Test.

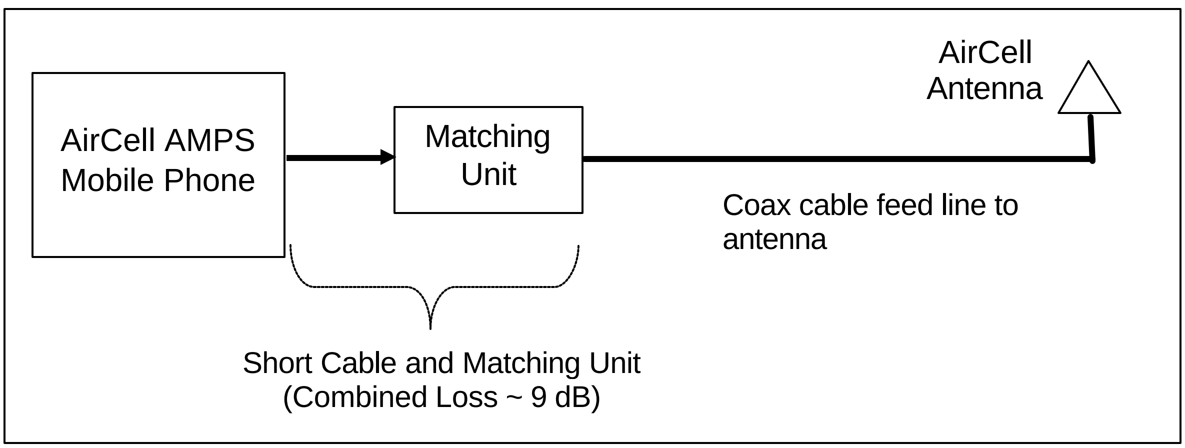
[10] During the V-COMM flight tests in 2001, AirCell "capped" the maximum DPC Level that mobiles can achieve on the AirCell Marlboro site to DPC level 3. For this reason, AirCell mobiles could not achieve the DPC level 2 on the Marlboro site, during the straight-line flight tests in 2001.

1.4 DPC Level to Power in dBm

The FCC Letter requests that the output power level of AirCell airborne transmitters be specified in units of dBm. Since the test equipment reports the output mobile power in terms of the phone's DPC level only, a conversion is needed to specify output power in dBm.

<u>AirCell Airborne Mobile Transmitter Equipment</u>

Below is a diagram of the AirCell mobile equipment utilized aboard the airplanes, as observed by V-COMM for three airplanes that were utilized in V-COMM's flight tests. All the equipment was installed at AirCell's factory authorized installation facilities. The equipment includes: an AMPS Mobile Phone, short coaxial cable about 2 feet in length, a matching unit providing insertion loss in the mobile transmit direction only, a long coaxial cable feeding an antenna that is either on the belly of the airplane or on the vertical stabilizer.



In 2001, V-COMM measured the combined insertion loss of the short coaxial cable and matching unit to an average of approximately 9 dB, with data from measurements performed on a few channels across the cellular band.[11] The length of the coax cable feed line to the antennas was measured to an average of approximately 20 feet, which has a loss of approximately 1.4 dB.[12]

With the insertion loss of AirCell's matching unit and coax feed-line, the *nominal* transmit power levels of AirCell's AMPS mobile phones can be computed in dBm units, at the output of the matching unit, and at the antenna. These *nominal* output power

[11] These measurements were performed on the AirCell phone equipment in the Navajo and Learjet airplanes, after all flight tests were completed in 2001. There were no measurements performed on the King Air airplane.

[12] The coax cable feed line is 1/2 inch double-shielded low-loss, equivalent RG-393 at 7 dB / 100 ft. @ 900 MHz. The insertion loss of 20 feet of this cable is approximately 1.4 dB.

levels (in dBm) are provided in Table 2 below, utilizing the *nominal* power levels for AMPS phones.[13]

Table 2 Nominal Transmit Power of AirCell AMPS Phone

Mobile Station Pwr Level	Nominal AMPS Spec. Mobile Ouptut Power dBm	mW	Matching Unit Loss dB	Nominal Ouput Power of AirCell phone/matching unit dBm	mW	Line Loss to Antenna dB	Nominal Tx Power at AirCell mobile antenna dBm	mW
2	28.0	631.0	9.0	**19.0**	**79.4**	1.4	17.6	57.5
3	24.0	251.2	9.0	**15.0**	**31.6**	1.4	13.6	22.9
4	20.0	100.0	9.0	**11.0**	**12.6**	1.4	9.6	9.1
5	16.0	39.8	9.0	**7.0**	**5.0**	1.4	5.6	3.6
6	12.0	15.8	9.0	**3.0**	**2.0**	1.4	1.6	1.4
7	8.0	6.3	9.0	**-1.0**	**0.8**	1.4	-2.4	0.6

As observed in Table 2 above, the AirCell transmitter *nominal* output power at DPC Level 2 is +19 dBm, as referenced to the output of the matching unit. And, the *nominal* power at the antenna (for 20 feet of coaxial feed line) is approximately +17.6 dBm. For DPC levels 3 through 7, each DPC step corresponds to a 4 dB decrement in power levels, as per the AMPS standard.

The *nominal* power level of +19 dBm at the matching unit output is exactly equal to the FCC's specified "transmitter output" limitations for airborne units, as per the FCC's waiver limitations for AirCell operation. Provided that AirCell mobile phones do not exceed the *nominal* AMPS power levels, the AirCell phones will not exceed FCC transmitter power limitations.[14]

In AirCell's response to the FCC's Dec 18th request for data, AirCell provides its "typical" power levels of its airborne units (in its Figure 10), which are lower than the *nominal* power levels provided above. AirCell provides their "typical" power levels without specifying the maximum range of their airborne transmitter's power levels.[15] It is

[13] The *nominal* power level for AMPS phones is specified by the FCC's OET "Cellular System Mobile Station - Land Mobile Compatibility Specification", OST Bulletin No. 53, Issued July 1983, in Table 2.1.2-1, entitled "Mobile Station Nominal Power Levels", and also are specified within the AMPS industry standards per TIA/EIA-553-A.

[14] In the AMPS standard, there are tolerances for mobile station power levels, and the maximum and minimum range of power levels include +2 dB (above) to -4 dB (below) the *nominal* power level. For any AirCell phones transmitting in the range above nominal power, to the +2 dB above nominal range (still within AMPS power level specs), will not comply with the FCC's power limitations pursuant to the AirCell waiver.

[15] AirCell submitted an explanation regarding its "typical' airborne power levels (filed on 2/13/04), in response to the FCC's questions from Feb. 4, 2004. In this filing, AirCell states its airborne transmit power levels are "typically" 2 dB below the AMPS specification, however it does not provide a range of operating power levels for its mobiles. As expected, the transmit power levels of AMPS phones will vary across production units, frequencies in the cellular band, temperature, supplied voltage, and over time. In 2001, after all V-COMM flight tests were

important to recognize that FCC power limitations do not merely require “typical” levels to be in compliance, but the “maximum” power level must also be in compliance. Accordingly, to avoid misrepresenting the power levels its units will achieve (and thus their interference potential), AirCell should also have submitted to the FCC the maximum power range of its airborne transmitters, and should also have explained the reasons why their AMPS mobile phones are not expected to exceed nominal AMPS power levels.

1.5 Other Comments re: AirCell’s Response to FCC Request for Data

In response to the FCC’s Dec. 18th request for data, AirCell submitted a report (dated 1/16/04) in the FCC’s proceeding for the AirCell waiver. Included in its report, AirCell provides data from what appears to be a total of 9 *controlled flight tests* performed by AirCell, consisting of a total of 9 phone calls of data.[16]

First, it should be noted that AirCell’s data is not from *actual* customers, but are collected as a result of “special tests” conducted by AirCell under controlled flight conditions. The Commission emphasized that they are *not* looking for such additional data.

AirCell acknowledges that its data is primarily from its routine controlled flight tests conducted across the country, as they do not regularly collect such data from actual customers.[17] Despite years of commercial operation pursuant to its waiver, it is surprising that a company that is sharing spectrum with cellular, portraying itself as a good cellular neighbor, and having a nearly-million mile database of flight test results, has not sufficiently sampled the transmitter power levels of their actual customers.

In its filing, AirCell also indicates that it is able to operate at lower received signal levels because they have cleared nearby co-channels from service. The fact that AirCell partnering carriers clear nearby co-channels from use is significant and may explain why no interference is experienced within partnering cellular providers’ markets, as

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completed, the maximum operating power level for two AirCell airborne terminals (in Navajo and Learjet aircraft) were measured to *only* 1 dB below the *nominal* AMPS power specification, which is higher than AirCell’s “typical” power level of 2 dB below the AMPS specification.

[16] AirCell’s flight test data is provided in its report in Figure 1, Figure 7-9, and other exhibits within Figure 12.

[17] However, AirCell indicates that its Figure 1 represents RF Trace data from an actual customer call. AirCell does not explain how they were able to capture a customer call with Lucent’s RF Call Trace function, which normally requires certain details of the call to be configured in the switch before the call is made, in order for the call to be captured by an RF Trace. These details include the particular AirCell site serving the phone call, the MIN of the AirCell phone making the call, the call duration, and the starting time of the call. For this reason, V-COMM presumes the call was made either as part of an AirCell controlled test or by a “friendly customer” with AirCell having previous knowledge of a call being placed on its system.

claimed by AirCell. In addition, it should be noted that "spectrum clearing" at multiple sites for the benefit of a secondary service offering is not an example of efficient spectrum use, and may only be possible within rural markets that are not using all their cellular channels. Also, the channels are not likely to be cleared within nearby suburban and urban markets, since these markets use their spectrum more intensively than do rural markets, and, as a result, AirCell airborne units traversing these market areas can generate co-channel interference.

In the conclusion of its report, AirCell states that its airborne mobile units operate at the average power level of DPC Level 4 (or +8dBm, per AirCell's power levels), with individual flight test results having the highest utilization at DPC level 3 or 4, depending on the flight test performed. For example, their exhibit for JuneQC2A_REV shows the DPC Level 3 utilized at 44% of the time for the flight test (the highest utilized, at +12.17 dBm output level).

Overall, in observing the results provided by AirCell's response, the mobile DPC percentages achieved by AirCell's tests are not substantially different from those levels recorded during V-COMM's 2001 flight tests with DPC Enabled, as submitted into the FCC proceeding for the AirCell waiver. Also, they are not substantially different than the levels recorded for the 5 site study performed by V-COMM and provided herein.

In its filing, AirCell submitted nine flight tests flown at altitudes ranging from 9,500 feet to 16,000 feet AMSL, depending on the test. With these medium range altitudes flown, in conjunction with the distances away from the AirCell serving sites for most of the flights, it is observed that the resultant incident angle of the received signal at the AirCell serving sites should be within the serving site's main vertical beam pattern of its antenna. This allows the airborne units to operate at lower transmit power levels, as compared to being served outside its main beam pattern. For example, flights at 40,000 feet and 40 miles away from its serving site, or flights at 45,000 feet and 50 miles away, or flights at 35,000 feet and 40 miles away, would be outside the serving site's main vertical beam pattern and operate at higher transmit power levels (at a lower DPC Step) than flights at the same distances and flying lower altitudes between 10,000 to 25,000 feet elevations. In order to fully assess of the range of power levels from airborne mobile units, data from all different altitudes and distances from its serving sites needs to be included in the analysis.

1.6 Conclusion

After reviewing the results of AirCell's controlled flight tests and V-COMM's recordings of actual customers provided in this report, the utilization of airborne transmit DPC levels appear to be consistent with the results of V-COMM's straight-line flight tests utilized in 2001, as filed within the FCC's AirCell proceeding.

It is observed that the AirCell system utilizes all of its mobile power levels (DPC Levels 2 through 7) to serve customer calls on its network, with individual AirCell sites achieving slightly different results. This can be attributed to a number of factors including the orientation and distance of the airplane flight route to serving AirCell site, altitude of flight, the type of aircraft antenna (VOR or belly mounted type) and the type of base station antenna utilized. Overall, the data indicates that the AirCell system uses all of its power levels for a significant portion of time.

In addition, with regard to V-COMM's Case Study flight profile (from DC to NJ), as previously provided to the Commission,[18] the mobile DPC levels attained for the flight route depicted still appear to be valid. Actually, with AirCell decommissioning the Marlboro/ Ellendale sites, slightly more than half of the Case Study flight route (56%) would now be served by the Pecks AirCell site, which is located further away from the route than the two previous serving sites.[19] Consequently, the airborne mobile power levels can be expected to operate at higher power levels than those indicated in V-COMM's Case Study.[20]

As a final point, in regard to the utilization of airborne transmit power levels, the data is relevant in understanding the operation of the AirCell system. However, because the FCC relies upon evaluating the compatibility of the AirCell system based upon a worst case assessment,[21] the highest operating power level of the AirCell system must be considered. Also, it is the higher operating power levels that occur when airborne AirCell mobiles are further from their serving sites and within neighboring adjacent cellular markets. And, based upon results of data provided in this report, the highest operating power level is utilized for a significant portion of time.

[18] The Case Study report section was provided in V-COMM's "Engineering Report of the AirCell Compatibility Test", submitted on 4/10/03, in the FCC's proceeding for the AirCell waiver.

[19] Without the Marlboro & Ellendale sites, the Pecks AirCell site is the closest site to the flight route, and would serve 126 miles of the total 224 miles of the route (56%). For this flight route, the distance to the Pecks site varies from 55 to 115 miles away from the flight route.

[20] At higher mobile power levels, the radius of harmful interference can be expected to increase, and the number of terrestrial cellular calls with harmful interference can also be expected to increase above the results indicated in the Case Study.

[21] In the FCC's Remand on Order (FCC 02-234), released on Feb. 10, 2003, the FCC relied upon a worst case or "Murphy's law" assessment for the compatibility of the AirCell system, and did not rely upon a probability study of the results.

2 Appendix

2.1 Exhibits of AirCell DPC Data Recordings

Figure 3 AirCell Mobile DPC Recordings for Marlboro AirCell Site

AirCell Mobile DPC Recordings

AirCell Site: Marlboro, NJ AirCell Site
Site Operator: Cingular Wireless

Study Period: 1/15/04 to 1/19/04
Cellular Band: A-Band

				Time (# seconds) per DPC Step						Total Call
Date	Day	Start/Stop	# Calls	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7	Time (sec)
1/15	THURS	3:00 PM	2		13	8				21
1/16	FRI	-	5		86			25		111
1/17	SAT	-	6				9	36	68	113
1/18	SUN	-	0							0
1/19	MON	11:00 AM	1				16			16
		Total # Calls:	14							
		Total Time, per DPC Step:		0	99	8	25	61	68	261
		Percentages, per DPC Step:		0%	38%	3%	10%	23%	26%	

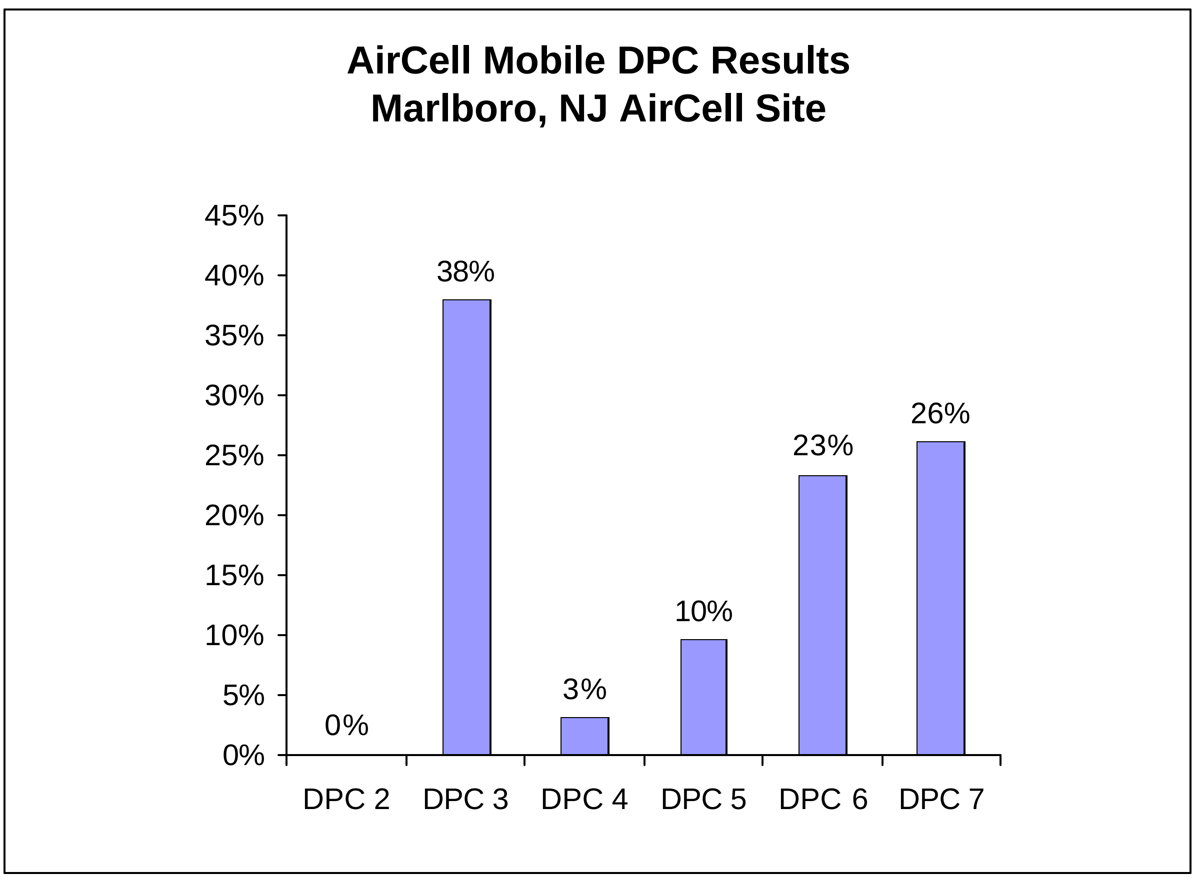


Figure 4 AirCell Mobile DPC Recordings for Ellendale AirCell Site

AirCell Mobile DPC Recordings

AirCell Site: Ellendale, DE AirCell Site — Study Period: 1/20/04 to 1/28/04
Site Operator: Cingular Wireless — Cellular Band: A-Band

				Time (# seconds) per DPC Step						Total Call
Date	Day	Start/Stop	# Calls	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7	Time (sec)
1/20	TUES	2:00 PM	7		12	29	173	71	170	455
1/21	WED	-	14		368	365	149	395	518	1795
1/22	THURS	-	5				151	60	124	335
1/23	FRI	-	5		46		132	25	74	277
1/24	SAT	-	1			207				207
1/25	SUN	-	6		8	159	140	175	184	666
1/26	MON	-	3					55	13	68
1/27	TUES	-	4			27	432	18		477
1/28	WED	9:00 AM	0							0
		Total # Calls:	45							
		Total Time, per DPC Step:		0	434	787	1177	799	1083	4280
		Percentages, per DPC Step:		0%	10%	18%	28%	19%	25%	

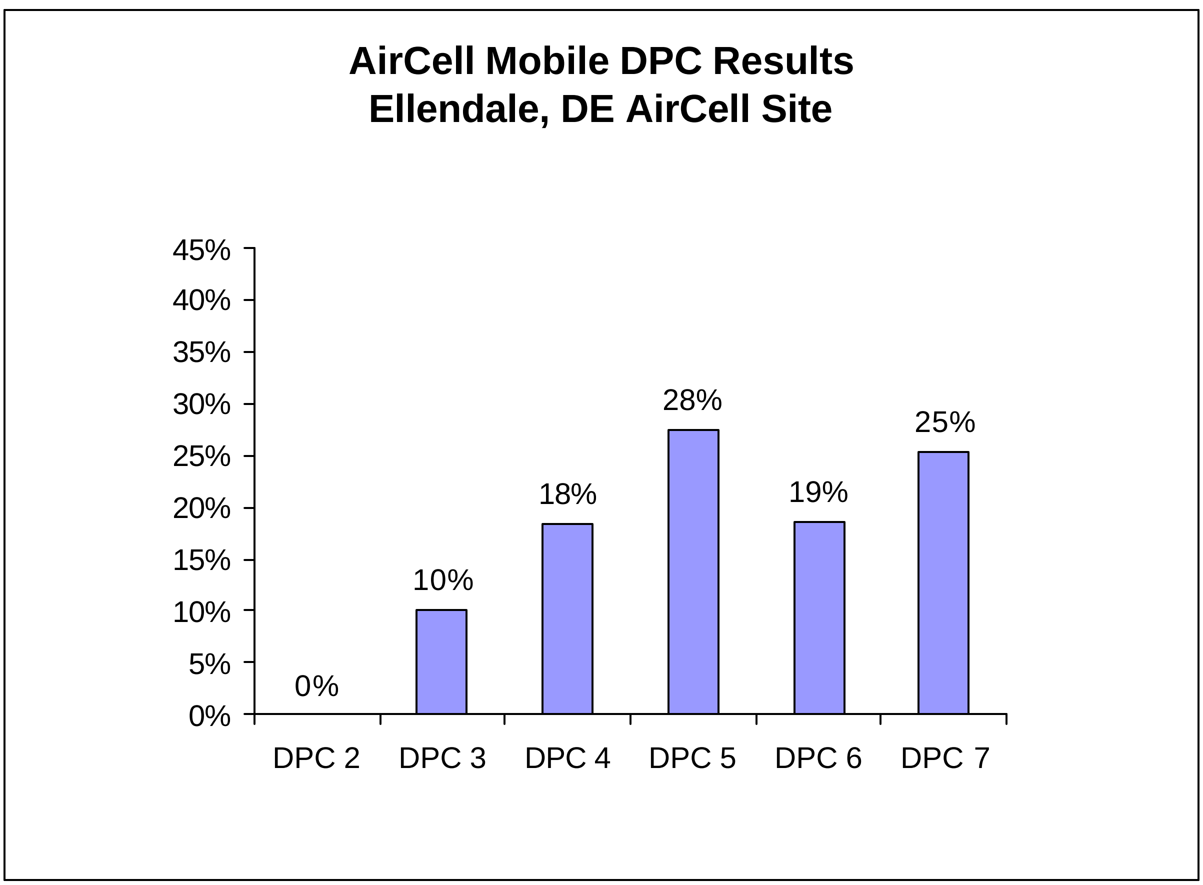


Figure 5 AirCell Mobile DPC Recordings for Pecks AirCell Site

AirCell Mobile DPC Recordings

AirCell Site:	Pecks, PA AirCell Site	Study Period:	1/22/04 to 1/27/04
Site Operator:	South Cannan Cellular (RSA PA5)	Cellular Band:	B-Band

				Time (# seconds) per DPC Step						Total Call
Date	Day	Start/Stop	# Calls	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7	Time (sec)
1/22	THURS	2:00 PM	2	115		110				225
1/23	FRI	-	5		99	62			138	299
1/24	SAT	-	2					131	120	251
1/25	SUN	-	7		428	137	79	69	32	745
1/26	MON	-	5			171	618	23		812
1/27	TUE	-	1				5			5
1/28	WED	-	0							0
1/29	THURS	8:00 PM	1				36			36
		Total # Calls:	23							
		Total Time, per DPC Step:		115	527	480	738	223	290	2373
		Percentages, per DPC Step:		5%	22%	20%	31%	9%	12%	

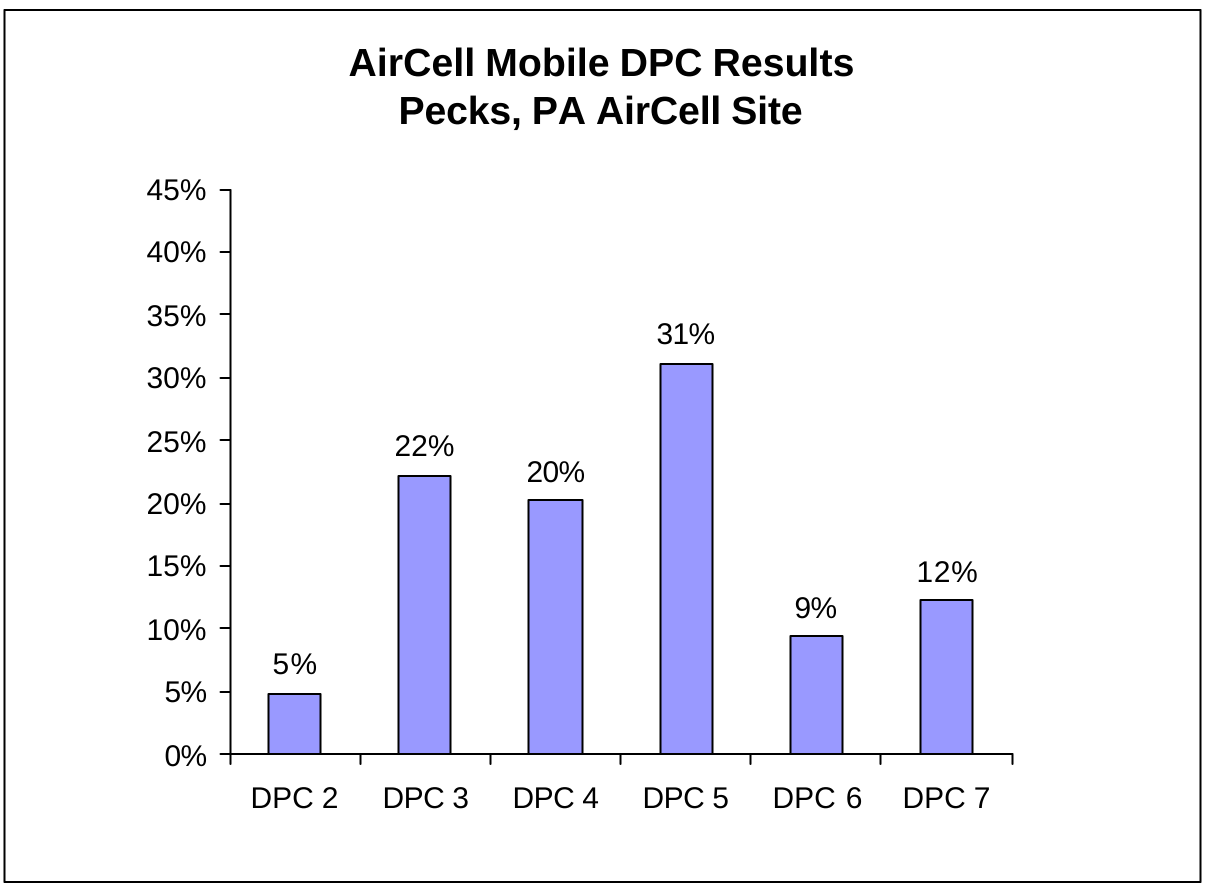


Figure 6 AirCell Mobile DPC Recordings for Altoona AirCell Site

AirCell Mobile DPC Recordings

AirCell Site: Altoona, PA AirCell Site
Site Operator: AT&T Wireless

Study Period: 1/29/04 to 2/5/04
Cellular Band: A-Band

				Time (# seconds) per DPC Step						Total Call
Date	Day	Start/Stop	# Calls	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7	Time (sec)
1/29	THURS	2:00 PM	1	1	20					21
1/30	FRI	-	4	2		71	252	28		353
1/31	SAT	-	0							0
2/1	SUN	-	0							0
2/2	MON	-	3	36		34				70
2/3	TUE	-	0							0
2/4	WED	-	3	70			114	50		234
2/5	THURS	11:30 AM	3	375	14	21				410
		Total # Calls:	14							
		Total Time, per DPC Step:		484	34	126	366	78	0	1088
		Percentages, per DPC Step:		44%	3%	12%	34%	7%	0%	

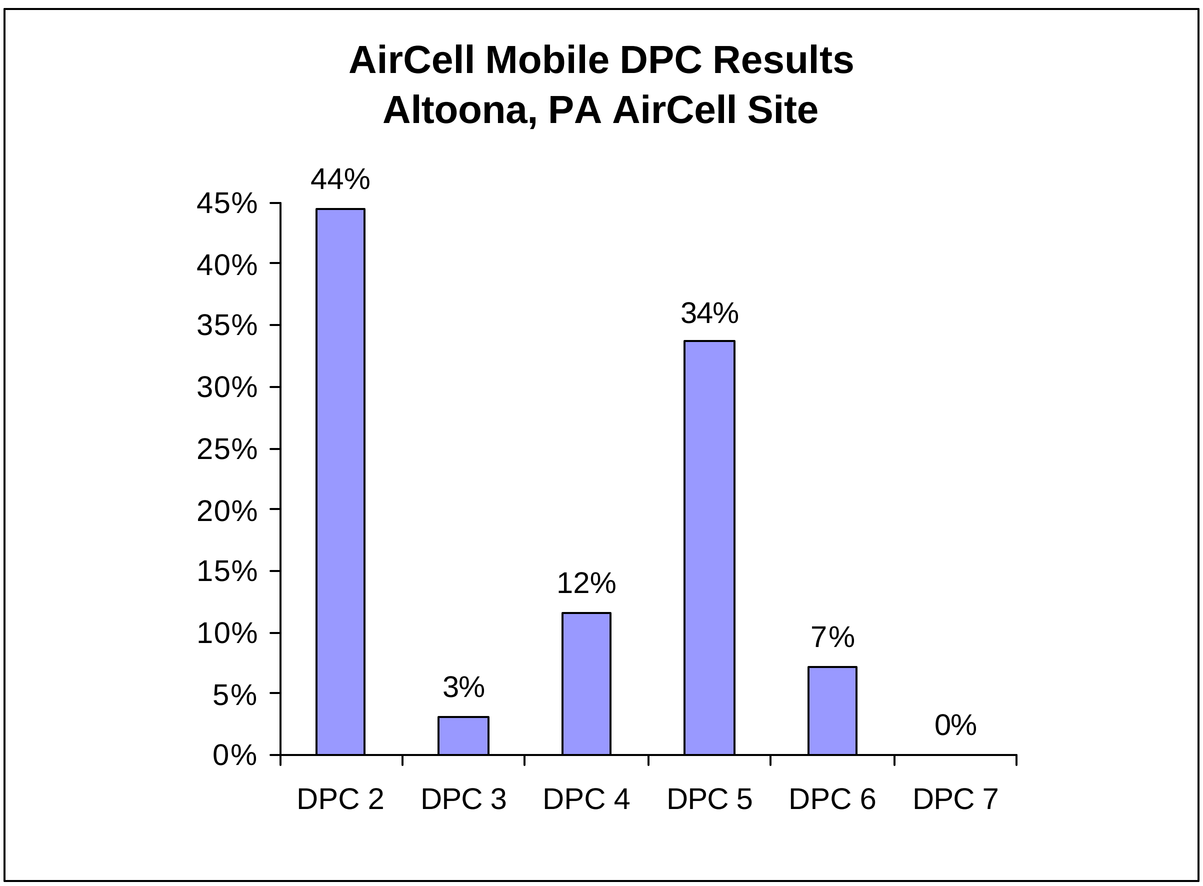


Figure 7 AirCell Mobile DPC Recordings for Owego AirCell Site

AirCell Mobile DPC Recordings

AirCell Site:	Owego, NY AirCell Site	Study Period:	1/30/04 to 2/6/04
Site Operator:	AT&T Wireless	Cellular Band:	A-Band

				Time (# seconds) per DPC Step						Total Call
Date	Day	Start/Stop	# Calls	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7	Time (sec)
1/30	FRI	2:00 PM	0							0
1/31	SAT	-	0							0
2/1	SUN	-	0							0
2/2	MON	-	1	14						14
2/3	TUES	-	0							0
2/4	WED	-	0							0
2/5	THURS	-	1					30		30
2/6	FRI	9:00 AM	0							0
		Total # Calls:	2							
		Total Time, per DPC Step:		14	0	0	0	30	0	44
		Percentages, per DPC Step:		32%	0%	0%	0%	68%	0%	

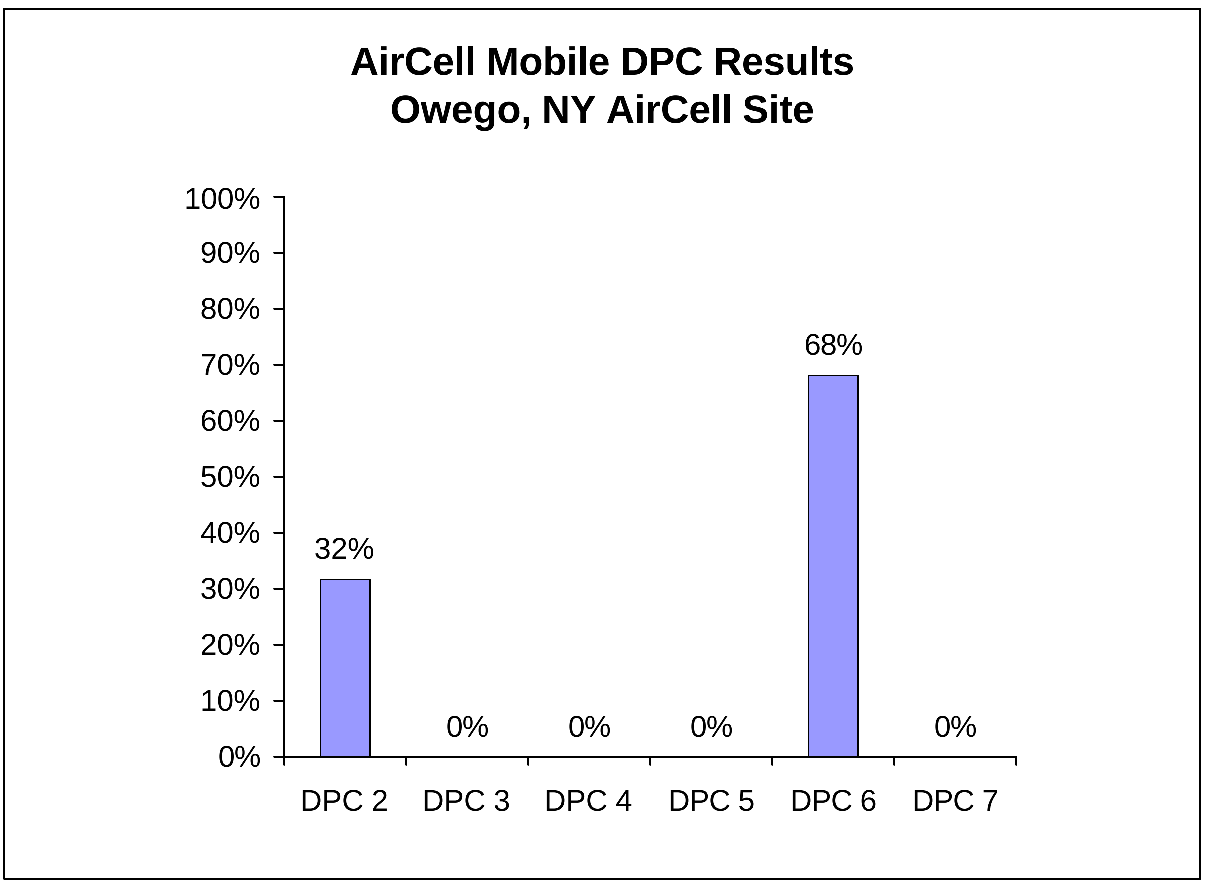
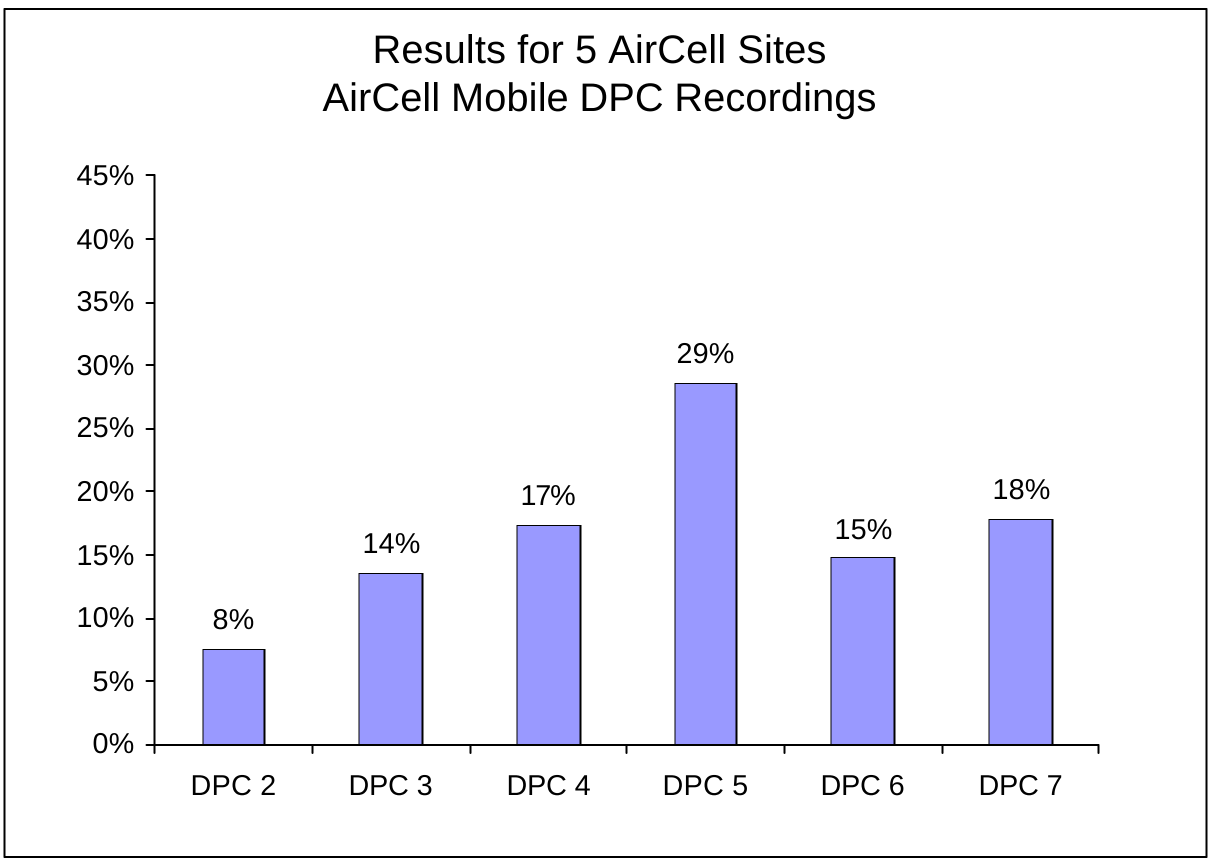


Figure 8 AirCell Mobile DPC Results for 5 AirCell Sites

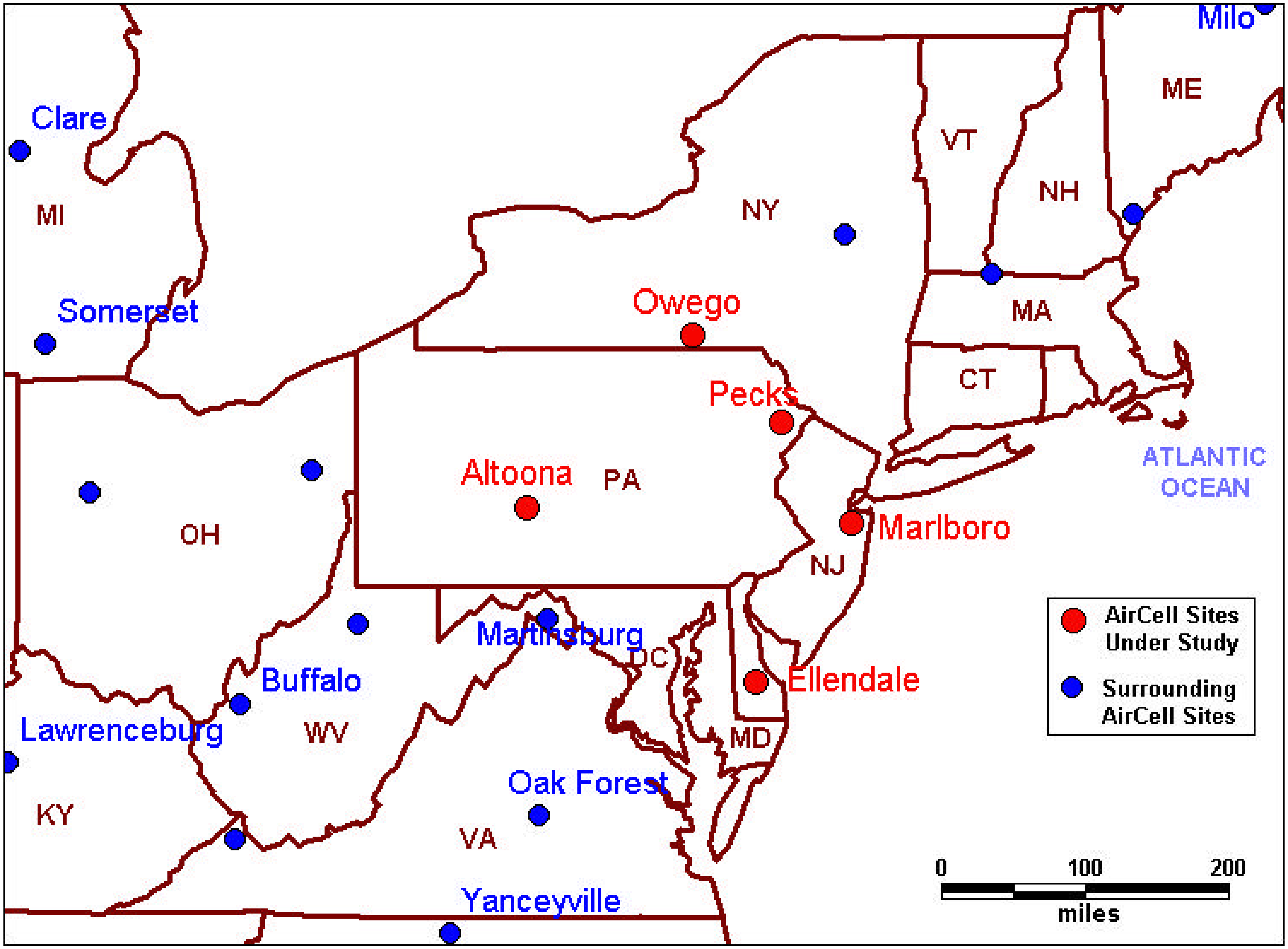
Results for 5 AirCell Sites
AirCell Mobile DPC Recordings

	AirCell Site	# Days	# Calls	Call Time (Minutes)	DPC 2	DPC 3	DPC 4	DPC 5	DPC 6	DPC 7
					DPC Step Percentages					
1	Marlboro, NJ	4	14	4.4	0%	38%	3%	10%	23%	26%
2	Ellendale, DE	8	45	71.3	0%	10%	18%	28%	19%	25%
3	Pecks, PA	7	23	39.6	5%	22%	20%	31%	9%	12%
4	Altoona, PA	7	14	18.1	44%	3%	12%	34%	7%	0%
5	Owego, NY	7	2	0.7	32%	0%	0%	0%	68%	0%
	TOTALS:	33	98	134.1						
	Total Time, per DPC Step (Minutes):				10.2	18.2	23.4	38.4	19.9	24.0
	Total Percentages, per DPC Step :				8%	14%	17%	29%	15%	18%



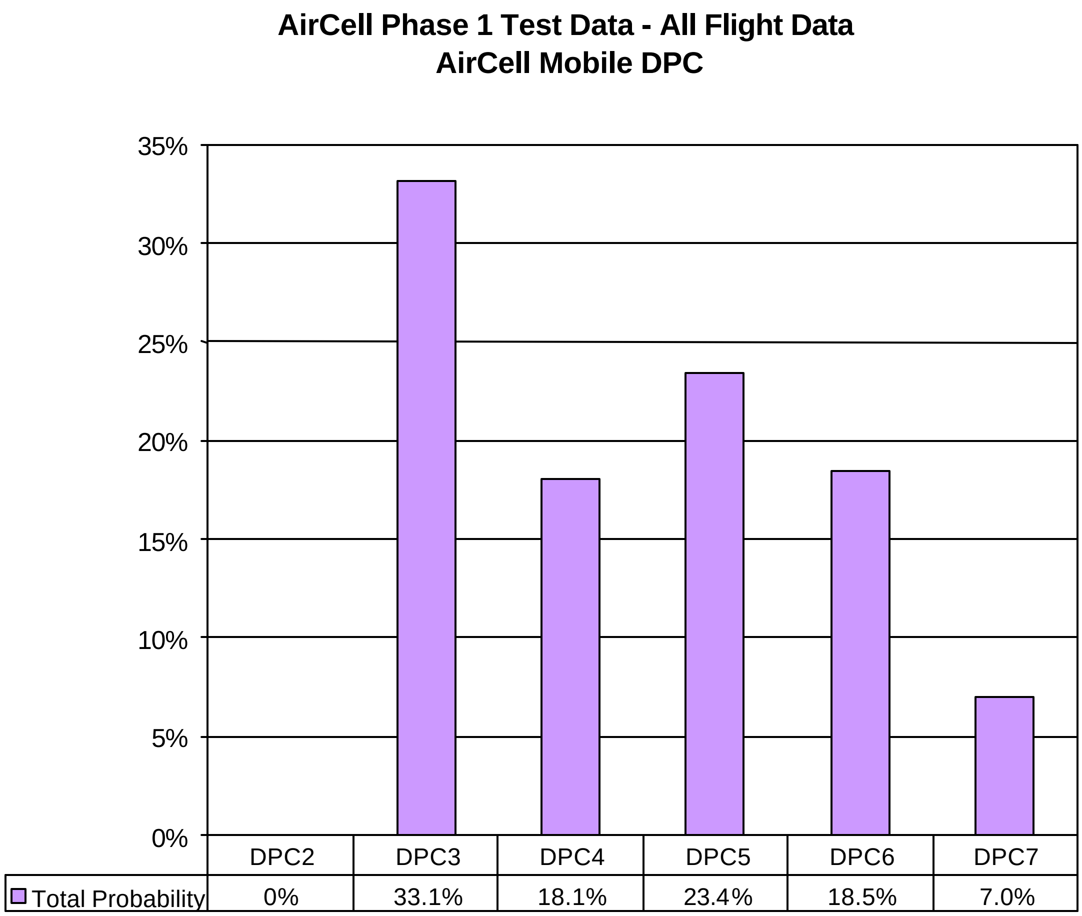
2.2 Map of AirCell Sites

Figure 9 Map of AirCell Sites Under Study



2.3 Exhibit from V-COMM's Phase 1 Flight Test Results

Figure 10 V-COMM's Phase 1 Flight Test Results for the Marlboro AirCell site, from Figure 3.3-A in "Engineering Report of the AirCell Compatibility Test", filed on 4/10/03



2.4 V-COMM Background Information

V-COMM is a leading provider of quality engineering and engineering related services to the worldwide telecommunications industry. V-COMM's staff of engineers are experienced in Cellular, Personal Communications Services (PCS), Enhanced Specialized Mobile Radio (ESMR), Paging, Wireless Data, Microwave, Signaling System 7, and Local Exchange Switching Networks. Further, V-COMM was selected by the FCC & Department of Justice to provide expert analysis and testimony in the Nextwave and Pocket Communications Bankruptcy cases. V-COMM has offices in Blue Bell, PA and Cranbury, NJ and provides services to both domestic and international markets. For additional information, please visit V-COMM's web site at www.vcomm-eng.com.

Biographies of Key Individuals

Dominic C. Villecco
President and Founder
V-COMM, L.L.C.

Dominic Villecco, President and founder of V-COMM, is a pioneer in wireless telecommunications engineering, with 22 years of executive-level experience and various engineering management positions. Under his leadership, V-COMM has grown from a start-up venture in 1996 to a highly respected full-service consulting telecommunications engineering firm.

In managing V-COMM's growth, Mr. Villecco has overseen expansion of the company's portfolio of consulting services, which today include a full range of RF & Network design, engineering & support; network design tools; measurement hardware; and software services; as well as time-critical engineering-related services such as business planning, zoning hearing expert witness testimony, regulatory advisory assistance, and project management.

Before forming V-COMM, Mr. Villecco spent 10 years with Comcast Corporation, where he held management positions of increasing responsibility, his last being Vice President of Wireless Engineering for Comcast International Holdings, Inc. Focusing on the international marketplace, Mr. Villecco helped develop various technical and business requirements for directing Comcast's worldwide wireless venture utilizing current and emerging technologies (GSM, PCN, ESMR, paging, etc.).

Previously he was Vice President of Engineering and Operations for Comcast Cellular Communications, Inc. His responsibilities included overall system design, construction and operation, capital budget preparation and execution, interconnection negotiations, vendor contract negotiations, major account interface, new product implementation, and cellular market acquisition. Following Comcast's acquisition of Metrophone, Mr. Villecco successfully merged the two technical departments and managed the combined department of 140 engineers and support personnel.

Mr. Villecco served as Director of Engineering for American Cellular Network Corporation (AMCELL), where he managed all system implementation and engineering design issues. He was responsible for activating the first cellular system in the world utilizing proprietary automatic call delivery software between independent carriers in Wilmington, Delaware. He also had responsibility for filing all FCC and FAA applications for AMCELL before it was acquired by Comcast.

Prior to joining AMCELL, Mr. Villecco worked as a staff engineer at Sherman and Beverage (S&B), a broadcast consulting firm. He designed FM radio station broadcasting systems and studio-transmitter link systems, performed AM field studies and interface analysis and TV interference analysis, and helped build a sophisticated six-tower arrangement for a AM antenna phasing system. He also designed and wrote software to perform FM radio station allocations pursuant to FCC Rules Part 73.

Mr. Villecco started his career in telecommunications engineering as a wireless engineering consultant at Jubon Engineering, where he was responsible for the design of cellular systems, both domestic and international, radio paging systems, microwave radio systems, two-way radio systems, microwave multipoint distribution systems, and simulcast radio link systems, including the drafting of all FCC and FAA applications for these systems.

Mr. Villecco has a BSEE from Drexel University, in Philadelphia, and is an active member of IEEE. Mr. Villecco also serves as an active member of the Advisory Council to the Drexel University Electrical and Computer Engineering (ECE) Department.

Relevant Expert Witness Testimony Experience

Over the past five years, Mr. Villecco had been previously qualified and provided expert witness testimony in the states of New Jersey, Pennsylvania, Delaware and Michigan. Mr. Villecco has also provided expert witness testimony in the following cases:

> United States Bankruptcy Court
>
> Nextwave Personal Communications, Inc. vs. Federal Communications Commission (FCC) **
>
> Pocket Communications, Inc. vs. Federal Communications Commission (FCC) **

** In these cases, Mr. Villecco was retained by the FCC and the Department of Justice as a technical expert on their behalf, pertaining to matters of wireless network design, optimization and operation.

David K. Stern
Vice President and Co-Founder
V-COMM, L.L.C.

David Stern, Vice President and co-founder of V-COMM, has over 20 years of hands-on operational and business experience in telecommunications engineering. He began his career with Motorola, where he developed an in-depth knowledge of wireless engineering and all the latest technologies such as CDMA, TDMA, and GSM, as well as AMPS and Nextel's iDEN.

While at V-COMM, Mr. Stern oversaw the design and implementation of several major Wireless markets in the Northeast United States, including Omnipoint - New York, Verizon Wireless, Unitel Cellular, Alabama Wireless, PCS One and Conestoga Wireless. In his position as Vice President, he has testified at a number of Zoning and Planning Boards in Pennsylvania, New Jersey and Michigan.

Prior to joining V-COMM, Mr. Stern spent seven years with Comcast Cellular Communications, Inc., where he held several engineering management positions. As Director of Strategic Projects, he was responsible for all technical aspects of Comcast's wireless data business, including implementation of the CDPD Cellular Packet Data network. He also was responsible for bringing into commercial service the Cellular Data Gateway, a circuit switched data solution.

Also, Mr. Stern was the Director of Wireless System Engineering, charged with evaluating new digital technologies, including TDMA and CDMA, for possible adoption. He represented Comcast on several industry committees pertaining to CDMA digital cellular technology and served on the Technology Committee of a wireless company on behalf of Comcast. He helped to direct Comcast's participation in the A- and B-block PCS auctions and won high praise for his recommendations regarding the company's technology deployment in the PCS markets.

At the beginning of his tenure with Comcast, Mr. Stern was Director of Engineering at Comcast, managing a staff of 40 technical personnel. He had overall responsibility for a network that included 250 cell sites, three MTSOs, four Motorola EMX-2500 switches, IS-41 connections, SS-7 interconnection to NACN, and a fiber optic and microwave "disaster-resistant" interconnect network.

Mr. Stern began his career at Motorola as a Cellular Systems Engineer, where he developed his skills in RF engineering, frequency planning, and site acquisition activities. His promotion to Program Manager-Northeast for the rapidly growing New York, New Jersey, and Philadelphia markets gave him the responsibility for coordinating all activities and communications with Motorola's cellular infrastructure customers. He directed contract preparations, equipment orders and deliveries, project implementation schedules, and engineering support services.

Mr. Stern earned a BSEE from the University of Illinois, in Urbana, and is a member of IEEE.

Sean Haynberg
Director of RF Technologies
V-COMM, L.L.C.

Sean Haynberg, Director of RF Technologies at V-COMM, has over 14 years of experience in wireless engineering. Mr. Haynberg has extensive experience in wireless system design, implementation, testing and optimization for wireless systems utilizing CDMA, TDMA, GSM, AMPS and NAMPS wireless technologies. In his career, he has conducted numerous first office applications, compatibility & interference studies, and new technology evaluations to assess, develop and integrate new technologies that meet industry and FCC guidelines. His career began with Bell Atlantic NYNEX Mobile, where he developed an in-depth knowledge of wireless engineering.

While at V-COMM, Mr. Haynberg was responsible for the performance of RF engineering team supplying total RF services to a diverse client group. Projects varied from managing a team of RF Engineers to design and implement new a PCS wireless network in the NY MTA; to the wireless system design & expansion of international markets in Brazil and Bermuda; to system performance testing and optimization for numerous markets in the north and southeast; to the development and procurement of hardware and software engineering tools; to special technology evaluations, system compatibility and interference testing. He has also developed tools and procedures to assist carriers in meeting compliance with FCC rules & regulations for RF Safety, and other FCC regulatory issues. In addition, Mr. Haynberg was instrumental in providing leadership, technical analysis, engineering expertise, and management of a team of RF

Engineers to deliver expert-level engineering analysis & reporting on behalf of the FCC & Department of Justice, in the Nextwave and Pocket Communications Bankruptcy proceedings.

Prior to joining V-COMM, Mr. Haynberg held various management and engineering positions at Bell Atlantic NYNEX Mobile (BANM). He was responsible for evaluating new technologies and providing support for the development, integration and implementation of first office applications (FOA), including CDMA, CDPD, and RF Fingerprinting Technology. Beyond this, Haynberg provided RF engineering guidelines and recommendations to the company's regional network operations, supported the deployment and integration of new wireless equipment and technologies, including indoor wireless PBX/office systems, phased/narrow-array smart antenna systems, interference and inter-modulation analysis and measurement, and cell site co-location and acceptance procedures. He was responsible for the procurement, development and support of engineering tools for RF, network and system performance engineers to enhance the system performance, network design and optimization of the regional cellular networks. He began his career as an RF Engineer responsible for the system design and expansion of over 100 cell sites for the cellular markets in New Jersey, Philadelphia, PA; Pittsburgh, PA; Washington, DC; and Baltimore, MD market areas.

Mr. Haynberg earned a Bachelor of Science degree in Electrical Engineering with high honors, and attended post-graduate work, at Rutgers University in Piscataway, New Jersey. While at Rutgers, Mr. Haynberg received numerous honors including membership in the National Engineering Honor Societies Tau Beta Pi and Eta Kappa Nu. In addition, Mr. Haynberg has been qualified, and provided expert witness testimony in the subject matter of RF engineering and the operation of wireless network systems for many municipalities in the state of New Jersey.